Docket No.: 05986/100K520-US1
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Rodolfo R. Llinas et al.

Application No.: 10/627,355 — Confirmation No.: 2328

Filed: July 24, 2003 — Art Unit: 2129

For: NEURO-MIMETIC CONTROL SYSTEMS AND METHODS — Examiner: P. D. Coughlan

APPEAL BRIEF

MS Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Appellants submit this Brief in accordance with 37 C.F.R. § 41.37 in support of their appeal from the Final Office Action, mailed May 22, 2009, by Examiner Peter D. Coughlan in the above-identified patent application.

In accordance with 37 C.F.R. §§ 41.31 and 41.37, this brief follows the September 22, 2009 filing of a Notice of Appeal and payment of the required fee. This brief is in support of said Notice of Appeal. Concurrently, herewith, Appellants submit a Petition for Extension of Time Pursuant to 37 C.F.R. § 1.136(a) requesting an extension of 2 months in which to submit this Appeal Brief. The requisite fee under 37 C.F.R. § 1.17(a) is also enclosed. With such petitions and fee, this Appeal Brief is due on or before January 22, 2010, and thus, is timely. Appellants submit that no further extension of time fee is required. However, the Commissioner is hereby authorized to charge any unpaid fees deemed required in connection with this Appeal Brief, or to credit any overpayment, to Deposit Account No. 04-0100.

The fees required under § 41.20(b)(2) are dealt with in the accompanying TRANSMITTAL OF APPEAL BRIEF.

This brief contains items under the following headings as required by 37 C.F.R. § 41.37 and M.P.E.P. § 1205.2:

I. REAL PARTY IN INTEREST

The real party in interest for this appeal is:

New York University

II. RELATED APPEALS AND INTERFERENCES

There are no other appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

A. Total Number of Claims in Application

There are 35 claims pending in application.

B. Current Status of Claims

1. Claims canceled: 1-11
2. Claims withdrawn from consideration but not canceled: None.
3. Claims pending: 12-46
4. Claims allowed: None.
5. Claims rejected: 12-46

C. Claims On Appeal

The claims on appeal are claims 12-46

IV. STATUS OF AMENDMENTS

Applicant did not file an Amendment After Final Rejection. The claims enclosed herein as Appendix A incorporate all the previous amendments to the claims.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The claims of the present invention are directed to a control circuit and method based on the inferior olive neuron. The control circuit generates an oscillation output signal. When the oscillation output signal crosses a first threshold, the control circuit generates a first spike. Similarly, when the oscillation output signal crosses a second threshold, the circuit generates a second spike. The oscillation output signal, the first spike signal and the second spike signal collectively form a composite output signal which is capable of controlling an actuating element. Additionally, characteristic information of the actuating element is provided as part of the input signal to the control circuit to thereby adjust one of the amplitude, phase and frequency of the oscillation output signal that is provided as a control for the actuating element. Thus, feedback is provided to the control circuit so that the control circuit can adjust the composite signal in response to the state of the controlled actuating element.

Independent claim 12 is directed to a control system. The control system includes a plurality of control circuits. (e.g., page 8, line 18-page 9, line 2). Each control circuit includes an input

receiving connection (e.g., page 14, lines 18-20; page 21, line 20-page 22, line 2), an oscillation generation circuit, a first spike generation circuit, and a second spike generation circuit (e.g., page 21, lines 8-11). The input receiving connection is for receiving an input signal. (e.g., page 14, lines 18-20; page 21, line 20-page 22, line 2). The oscillation generation circuit is for generating at a first output terminal (e.g., page 22, lines 4-6) an oscillation output signal having an amplitude, phase and a frequency. The first spike generation circuit is in communication with the oscillation generation circuit. (e.g., figs. 3 and 10). The first spike generation circuit is for generating a first spike signal when the oscillation output signal crosses a first threshold value. (e.g., page 14, line 20-page 15, line 1; original claim 1). The first spike signal is provided at the first output terminal. (e.g., page 22, lines 4-6). The second spike generation circuit is also in communication with the oscillation generation circuit. (e.g., figs. 3 and 10). The second spike generation circuit is for generating a second spike signal when the oscillation output signal crosses a second threshold value. (e.g., page 14, line 20-page 15, line 1; original claim 1). The second spike signal is provided at the first output terminal. (e.g., page 22, lines 4-6). The oscillation output signal, the first spike signal and the second spike signal collectively form a composite output signal (e.g., page 22, lines 4-6) which is capable of controlling an actuating element (e.g., page 30, lines 8-11; page 32, line 22-page 33, line 2). Characteristic information of the actuating element is provided as part of the input signal to the control circuit (e.g., page 29, lines 6-7 and 16-22) to thereby adjust one of the amplitude, phase and frequency of the oscillation output signal provided as a control for the actuating element (e.g., page 14, lines 18-20; page 15, lines 19-20; page 16, lines 7-8).

Independent claim 20 is directed to a control system. The control system includes a plurality of control circuits. (e.g., page 8, line 18-page 9, line 2). Each control circuit includes an input receiving connection (e.g., page 14, lines 18-20; page 21, line 20-page 22, line 2), an oscillation generation circuit, a first spike generation circuit, and a second spike generation circuit (e.g., page 21, lines 8-11). The input receiving connection is for receiving an input signal. (e.g., page 14, lines 18-20; page 21, line 20-page 22, line 2). The oscillation generation circuit is for generating at a first output terminal (e.g., page 22, lines 4-6) and a second output terminal (e.g., page 22, lines 3-4) an oscillation output signal having an amplitude, phase and a frequency. The first spike generation circuit is in communication with the oscillation generation circuit. (e.g., figs. 3 and 10). The first

spike generation circuit is for generating a first spike signal when the oscillation output signal crosses a first threshold value. (e.g., page 14, line 20-page 15, line 1; original claim 1). The first spike signal is provided at the first output terminal (e.g., page 22, lines 4-6) and the second output terminal (e.g., page 22, lines 3-4). The second spike generation circuit is also in communication with the oscillation generation circuit. (e.g., figs. 3 and 10). The second spike generation circuit is for generating a second spike signal when the oscillation output signal crosses a second threshold value. (e.g., page 14, line 20-page 15, line 1; original claim 1). The second spike signal is provided at the first output terminal. (e.g., page 22, lines 4-6). The oscillation output signal, the first spike signal and the second spike signal collectively form a first composite output signal at the first output terminal. (e.g., page 22, lines 4-6). The oscillation output signal and the first spike signal collectively form a second composite output signal at the second output terminal. (e.g., page 22, lines 3-4). At least one of the composite output signals is capable of controlling an actuating element (e.g., page 30, lines 8-11; page 32, line 22-page 33, line 2). Characteristic information of the actuating element is provided as part of the input signal to the control circuit (e.g., page 29, lines 6-7 and 16-22) to thereby adjust one of the amplitude, phase and frequency of the oscillation output signal provided as a control for the actuating element (e.g., page 14, lines 18-20; page 15, lines 19-20; page 16, lines 7-8).

Independent claim 28 is directed to a robotic control system. The control system includes a plurality of control circuits. (e.g., page 8, line 18-page 9, line 2). Each control circuit includes an input receiving connection (e.g., page 14, lines 18-20; page 21, line 20-page 22, line 2), an oscillation generation circuit, a first spike generation circuit, and a second spike generation circuit (e.g., page 21, lines 8-11). The input receiving connection is for receiving an input signal. (e.g., page 14, lines 18-20; page 21, line 20-page 22, line 2). The oscillation generation circuit is for generating at a first output terminal (e.g., page 22, lines 4-6) an oscillation output signal having an amplitude, phase and a frequency. The first spike generation circuit is in communication with the oscillation generation circuit. (e.g., figs. 3 and 10). The first spike generation circuit is for generating a first spike signal when the oscillation output signal crosses a first threshold value. (e.g., page 14, line 20-page 15, line 1; original claim 1). The first spike signal is provided at the first output terminal. (e.g., page 22, lines 4-6). The second spike generation circuit is also in

communication with the oscillation generation circuit. (e.g., figs. 3 and 10). The second spike generation circuit is for generating a second spike signal when the oscillation output signal crosses a second threshold value. (e.g., page 14, line 20-page 15, line 1; original claim 1). The second spike signal is provided at the first output terminal. (e.g., page 22, lines 4-6). The oscillation output signal, the first spike signal and the second spike signal collectively form a composite output signal (e.g., page 22, lines 4-6) which is capable of controlling an actuating element (e.g., page 30, lines 8-11; page 32, line 22-page 33, line 2). A sensor is used to obtain characteristic information of the actuating element (e.g., page 29, lines 6-7 and 16-22). The characteristic information is provided as part of the input signal (e.g., page 29, lines 6-7 and 16-22) to the control circuit to thereby adjust one of the amplitude, phase and frequency of the oscillation output signal (e.g., page 14, lines 18-20; page 15, lines 19-20; page 16, lines 7-8). The input signal is used to synchronize controlled movement of the actuation elements associated with the control circuits. (e.g., page 30, lines 1-5; page 32, line 22-page 33, line 4).

Independent claim 29 is directed to a method of controlling a system. The method includes using a plurality of control circuits. (e.g., page 8, line 18-page 9, line 2). In the recited method, each control circuit receives an input signal (e.g., page 14, lines 18-20; page 21, line 20-page 22, line 2); generates an oscillation output signal at a first output terminal having an amplitude, phase and a frequency, (e.g., page 22, lines 4-6); generates a first spike signal when the oscillation output signal crosses a first threshold value (e.g., page 14, line 20-page 15, line 1; original claim 1); and generates a second spike signal when the oscillation output signal crosses a second threshold value (e.g., page 14, line 20-page 15, line 1; original claim 1). The input signal is received at an input receiving connection. (e.g., page 14, lines 18-20; page 21, line 20-page 22, line 2). The first spike signal is provided at the first output terminal. (e.g., page 22, lines 4-6). The second spike signal is provided at the first output terminal. (e.g., page 22, lines 4-6). The oscillation output signal, the first spike signal and the second spike signal collectively form a composite output signal (e.g., page 22, lines 4-6) which is capable of controlling an actuating element (e.g., page 30, lines 8-11; page 32, line 22-page 33, line 2). Characteristic information of the actuating element is provided as part of the input signal to the control circuit (e.g., page 29, lines 6-7 and 16-22) to thereby adjust one of

the amplitude, phase and frequency of the oscillation output signal provided as a control for the actuating element (e.g., page 14, lines 18-20; page 15, lines 19-20; page 16, lines 7-8).

Independent claim 37 is directed to a method of controlling a system. The method includes using a plurality of control circuits. (e.g., page 8, line 18-page 9, line 2). In the recited method, each control circuit receives an input signal (e.g., page 14, lines 18-20; page 21, line 20-page 22, line 2); generates an oscillation output signal at a first output terminal (e.g., page 22, lines 4-6) and a second output terminal (e.g., page 22, lines 3-4) having an amplitude, phase and a frequency; generates a first spike signal when the oscillation output signal crosses a first threshold value (e.g., page 14, line 20-page 15, line 1; original claim 1); and generates a second spike signal when the oscillation output signal crosses a second threshold value (e.g., page 14, line 20-page 15, line 1; original claim 1). The input signal is received at an input receiving connection. (e.g., page 14, lines 18-20; page 21, line 20-page 22, line 2). The first spike signal is provided at the first output terminal (e.g., page 22, lines 4-6) and the second output terminal (e.g., page 22, lines 3-4). The second spike signal is provided at the first output terminal. (e.g., page 22, lines 4-6). The oscillation output signal, the first spike signal and the second spike signal collectively form a first composite output signal at the first output terminal. (e.g., page 22, lines 4-6). The oscillation output signal and the first spike signal collectively form a second composite output signal at the second output terminal. (e.g., page 22, lines 3-4). At least one of the composite output signals is capable of controlling an actuating element (e.g., page 30, lines 8-11; page 32, line 22-page 33, line 2). Characteristic information of the actuating element is provided as part of the input signal to the control circuit (e.g., page 29, lines 6-7 and 16-22) to thereby adjust one of the amplitude, phase and frequency of the oscillation output signal provided as a control for the actuating element (e.g., page 14, lines 18-20; page 15, lines 19-20; page 16, lines 7-8).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Whether claims 19, 27, 36, and 44 are unpatentable under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement.

Whether claims 12, 13, 18-21, 26-30, 35-38, 43, 44 and 46 are unpatentable under 35 U.S.C. § 103(a) over "Microelectronic circuits" by Sedra et al. ("Sedra") in view of "Cerebellar Learning for Control of a two Link Arm in Muscle Space" by Fagg et al. ("Fagg").

Whether claims 14-17, 22-25, 31-34, and 39-42 are unpatentable under 35 U.S.C. § 103(a) over the combination of Sedra and Fagg in view of "Homoclinic orbits and solitary waves in a one dimensional array of Chua's circuits" by Nekorkin et al. ("Nekorkin").

Whether claim 45 is unpatentable under 35 U.S.C. § 103(a) over the combination of Sedra and Fagg in view of U.S. Patent No. 4,720,689 to Gontowski ("Gontowski").

VII. ARGUMENT

Rejection of claims 19, 27, 36, and 44 under 35 U.S.C. § 112, first paragraph.

Claims 19, 27, 36, and 44 were rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. It is respectfully submitted that the rejections under 35 U.S.C. § 112, first paragraph, are improper and should be withdrawn.

Claims 19, 27, 36, and 44 require:

> a first cluster of control circuits and a second cluster of control circuits, the first cluster of control circuits being characterized by a higher degree of coupling between control circuits of the first cluster relative to a lower degree of coupling between control circuits of the first cluster and control circuits of the second cluster.

According to the Examiner, these claims fail to satisfy the written description requirement because the Specification, which states "[g]enerally, the coupling between units inside a cluster is stronger than between units at the boundary of clusters," (Specification, page 48, line 22-page 49, line 1) is not as precise as the claims. (See Detailed Action, page 3).

The claims of the present invention are directed to a control circuit and method based on the inferior olive neuron. With respect to the inferior olive neuron, the Specification of the present application makes clear that "[a]s the coupling among neurons increases, the degree of synchronization of the neurons increases. As has been experimentally observed, closely coupled IO neurons form oscillatory clusters." (Specification, page 27, lines 5-7). Thus, inferior olive neurons form clusters when closely coupled. Because cluster formation is a function of the degree of coupling between neurons, it follows that neurons within a cluster are more closely coupled to other neurons within the same cluster than they are to neurons in a different cluster. Claims 19, 27, 36, and 44 are directed to this feature of the neuron model. Accordingly, Appellant submits that the rejections under 35 U.S.C. § 112, first paragraph, are improper and should be withdrawn.

Rejection of claims 12-46 under 35 U.S.C. § 103(a):

Claims 12, 13, 18-21, 26-30, 35-38, 43, 44 and 46 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Sedra in view of Fagg. Claims 14-17, 22-25, 31-34, and 39-42 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Sedra and Fagg in view of Nekorkin. Claim 45 was rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Sedra and Fagg in view of Gontowski.

Independent claim 12 is directed to a circuit for controlling an actuator. The control circuit generates an oscillation output signal. When the oscillation output signal crosses a first threshold, the control circuit generates a first spike. Similarly, when the oscillation output signal crosses a second threshold, the circuit generates a second spike. The oscillation output signal, the first spike signal, and the second spike signal collectively form a composite output signal which is capable of controlling an actuating element. Additionally, characteristic information of the actuating element is provided as part of the input signal to the control circuit to thereby adjust one of the amplitude, phase, and frequency of the oscillation output signal. Thus, feedback is provided to the control circuit so that the control circuit can adjust the composite signal in response to the state of the controlled actuating element.

Spike generation is dependent upon the frequency of the oscillation signal and the threshold levels. "[T]he firing frequency of the IO neurons is limited by the frequency of the sub-threshold oscillations as the action potential is generated only at voltages near the peak of the oscillation." (Specification, page 18, lines 17-19). However, "the firing frequency can be tuned with the parameters I_1 and I_2 of Eqs. 2a, 2b and 3a, 3b whose values move the base line of the sub-threshold oscillations up or down with respect to the spike firing thresholds." (Specification, page 18, lines 15-17). I_1 and I_2 are control parameters representing constant current stimuli that change the membrane potential level of the inferior olive neuron model. (Specification, page 14, lines 8-9).

Generation of spikes when the oscillation signal crosses a threshold is described in the Specification, for example, at page 17, line 6-page 18, line 22. "At rest, the oscillations of the membrane potential are below the spike-inducing threshold." (Specification, page 17, lines 10-11).

Spiking occurs when the membrane of the IO neuron is depolarized to the point at which the threshold for spiking is met. (Specification, page 17, lines 15-17). Spikes due to depolarization are generated by the high-threshold pulse generator 12. (Specification, page 17, lines 17-18). "[I]n addition to firing at depolarized levels, the IO neuron model 10 also fires at hyperpolarized levels…." (Specification, page 17, lines 20-21). "In the case of hyperpolarization, the low threshold spikes are generated by the activation of the [low-threshold] pulse generator 13." (Specification, page 18, lines 3-5). Thus, spikes are fired by the high-threshold pulse generator 12 when the oscillating signal crosses a first threshold, and are fired by the low-threshold pulse generator 13 when the oscillation signal crosses a second threshold.

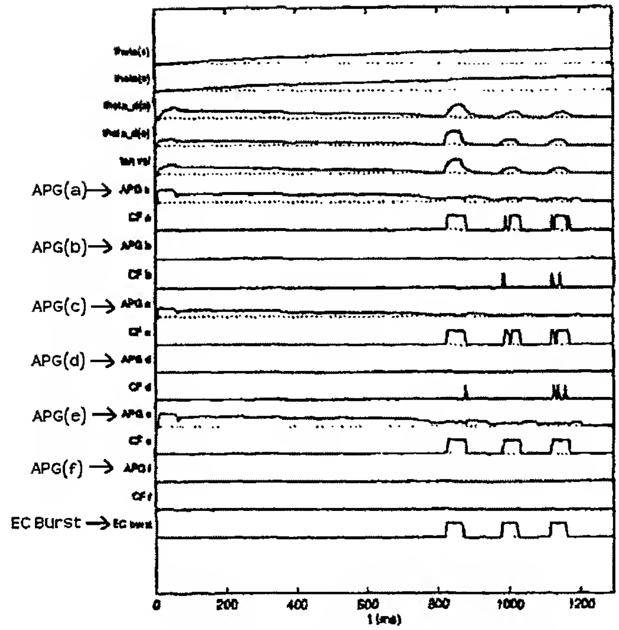
Examples of composite signals including an oscillation signal and spikes according to an exemplary model of the present invention may be found in Figs. 5 and 6 of the Specification. Fig. 5A illustrates the output of an exemplary model of the present invention for a depolarized condition, which corresponds to the oscillation signal crossing the first threshold. (Specification, page 17, lines 14-16). Fig. 6A illustrates the output of an exemplary model of the present invention for a hyperpolarized condition, which corresponds to the oscillation signal crossing the second threshold. (Specification, page 17, line 20-page 18, line 6). Note that the labeling of the first threshold and the second threshold in the description above is arbitrary.

With respect to independent claim 12, the Examiner contends that Sedra teaches a plurality of control circuits comprising an input receiving connection for receiving an input signal and an oscillation generation circuit for generating at a first output terminal an oscillation output signal having an amplitude, a phase, and a frequency. (See Detailed Action, page 4). The Examiner further contends that Sedra discloses adjusting the amplitude and the frequency of the oscillation output signal. (See Detailed Action, page 7). The Examiner admits that Sedra does not teach the remaining claim features, but contends that Fagg discloses these features. (See Detailed Action, pages 4-7). Appellant respectfully disagrees with the Examiner's contention that the combination of Sedra and Fagg discloses each and every feature of independent claim 12.

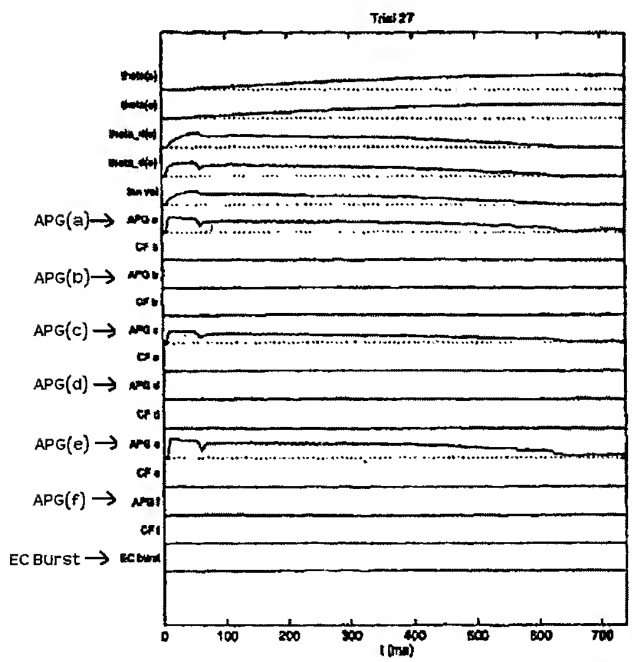
Appellant submits that Fagg describes a model for simulating the movement of an arm. Arm movements are controlled by two different control modules and an inferior olive module (See Fagg, pages 2638–2639). The first control module is the cerebellar module, which is constructed from an array of adjustable pattern generators ("APGs"), each of which drives a single muscle. (See Fagg, page 2638). The cerebellar module is a learning module that is primarily responsible for moving the arm to a goal. (See Fagg, pages 2638–2639). The second control module is the Extra-Cerebellar ("EC") module, which is responsible for moving the arm to the goal when the cerebellar module fails to move the arm close enough to the goal. (See Fagg, page 2639). When activated, the EC module produces a short constant burst of activity in muscle space that brings the arm closer to the goal. (See Fagg, page 2639). The inferior olive estimates movement errors by observing muscle length changes in response to corrective motor commands generated by the EC module. (See Fagg, page 2639). This error information is used to update the APGs. (See Fagg, page 2639). Ideally, after a number of attempts and as a result of this learning process, the cerebellar module can move the arm to the goal without the help of the EC module.

According to the Examiner, Fagg teaches "a first spike generation circuit in communication with the oscillation generation circuit for generating a first spike signal when the oscillation output signal crosses a first threshold value," as recited by claim 12. (See Detailed Action, page 5). Specifically, the Examiner contends that the APG of Fagg is equivalent to the first spike generation circuit. (See Detailed Action, page 5). The Examiner also states that "[t]he 'first threshold' of applicant is disclosed by the desire to move the 'single muscle' of Fagg." (See Detailed Action, page 5).

Appellant respectfully submits that the APG of Fagg is not a spike generator. Figures 5 and 7 of Fagg, which are reproduced below, illustrate the signals that drive the muscles that move the arm. (See Fagg, pages 2642-2643). As can be seen from these figures, the signals APG(a)-APG(f), are not comprised of spikes, but instead vary smoothly with no discernable pattern.



Fagg, Fig. 5 (Labels to left added for clarity)



Fagg, Fig. 7 (Labels to left added for clarity)

Further, Appellant respectfully submits that the Examiner mischaracterizes the "first threshold" of claim 12. The first and second thresholds of claim 12 correspond to signal levels that the output of an oscillation circuit crosses. The output of a circuit is a signal having a voltage and a current, and thus, the threshold corresponds to a signal level associated with either the voltage or current of the signal. In contrast, the Examiner's contention is that the first threshold corresponds to a desire to move a single muscle of a modeled arm. (See Detailed Action, page 5). A desire to move a muscle is not the same as the first threshold recited by claim 12.

According to the Examiner, Fagg also teaches "a second spike generation circuit in communication with the oscillation generation circuit for generating a second spike signal when the oscillation output signal crosses a second threshold value," as recited by claim 12. (See Detailed Action, page 5). Specifically, the Examiner contends that the EC module of Fagg is equivalent to the second spike generation circuit. (See Detailed Action, page 5). The Examiner also states that "[t]he 'second threshold' of applicant is if the arm reaches its goal or not. If the arm reached the goal, then the threshold has not been crossed. If the arm did not reach the goal, then the threshold has been crossed." (See Detailed Action, page 5).

Appellant respectfully submits that the Examiner mischaracterizes the second threshold of claim 12. As discussed above with respect to the first threshold, the second threshold of claim 12 corresponds to a particular signal level that an oscillation output signal crosses. The threshold pointed to by the Examiner, i.e., whether the arm reached the goal, is not the same type of threshold as contemplated by the claimed invention.

In light of the foregoing, Appellant respectfully submits that the combination of Sedra and Fagg does not disclose each and every element of independent claim 12, and thus, independent claim 12 is patentable over the cited references. Accordingly, Appellant respectfully submits that the rejection of claim 12 under 35 U.S.C. § 103(a) over Sedra in view of Fagg is improper and should be withdrawn.

Appellant further submits that independent claims 20, 28, 29, and 37 are also patentable over the cited references. Claims 20 and 28, like claim 12, each include first and second spike generation

circuits that generate spikes when an oscillation output signal crosses a first and a second threshold respectively. Similarly, claims 29 and 37, which are directed to methods, include the steps of generating a first and a second spike signal when an oscillation output signal crosses a first and a second threshold respectively. Therefore, the foregoing arguments with respect to claim 12 are equally applicable to these claims. Thus, Appellant respectfully submits that the combination of Sedra and Fagg does not disclose each of the limitations of independent claims 20, 28, 29, and 37, and thus, these claims are patentable over the cited references. Accordingly, Appellant respectfully submits that the rejections of independent claims 20, 28, 29, and 37 under 35 U.S.C. § 103(a) over Sedra in view of Fagg are improper and should be withdrawn.

Moreover, neither of the other references cited by the Examiner, i.e., Nekorkin and Gontowski, teaches or suggests the above-recited features of independent claims 12, 20, 28, 29, and 37. Nekorkin merely describes a study of study of solitary waves in an array of inductively coupled Chua's circuits. (See Nekorkin, page 785). Gontowski merely describes a precision oscillator that can be synchronized to other oscillators connected in parallel to the precision oscillator. (See Gontowski, Abstract). Thus, neither Nekorkin nor Gontowski cures the deficiencies of the combination of Sedra and Fagg with respect to the above-recited features. Accordingly, Appellant submits that claims 13-19, 21-27, 30-36, and 38-42, which are each dependent upon one of claims 12, 20, 28, 29, and 37, are allowable at least by reason of dependency upon an allowable base claim. Consequently, Appellant respectfully submits that the rejections of claims 12, 13, 18-21, 26-30, 35-38, 43, 44 and 46 under 35 U.S.C. § 103(a) over the combination of Sedra and Fagg, of claims 14-17, 22-25, 31-34, and 39-42 under 35 U.S.C. § 103(a) over the combination of Sedra, Fagg, and Nekorkin, and of claim 45 under 35 U.S.C. § 103(a) over the combination of Sedra, Fagg, and Gontowski are improper and should be withdrawn.

VIII. CLAIMS

A copy of the claims involved in the present appeal is attached hereto as Appendix A.

CONCLUSION

For the foregoing reasons, the final rejection of claims 12-46 should be reversed. Appellant respectfully requests that the application be remanded to the Primary Examiner with instruction to withdraw the rejections under 35 U.S.C. §112, first paragraph and §103(a), and pass the case to the allowance.

The Commissioner is hereby authorized to charge any unpaid fees deemed required in connection with this submission, including any additional filing or application processing fees required.

Dated: December 23, 2009

Respectfully submitted,

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APPENDIX A

Claims Involved in the Appeal of Application Serial No. 10/627,355

12. (Previously presented) A control system comprising:

a plurality of control circuits, each control circuit comprising the following elements:

an input receiving connection for receiving an input signal;

an oscillation generation circuit for generating at a first output terminal an oscillation output signal having an amplitude, phase and a frequency;

a first spike generation circuit in communication with the oscillation generation circuit for generating a first spike signal when the oscillation output signal crosses a first threshold value, the first spike signal being provided at the first output terminal;

a second spike generation circuit in communication with the oscillation generation circuit for generating a second spike signal when the oscillation output signal crosses a second threshold value, the second spike signal being provided at the first output terminal;

wherein the oscillation output signal, the first spike signal and the second spike signal collectively form a composite output signal which is capable of controlling an actuating element, and wherein characteristic information of the actuating element is provided as part of the input signal to the control circuit to thereby adjust one of the amplitude, phase and frequency of the oscillation output signal.

13. (Previously presented) The control system of claim 12, wherein a phase characteristic of the composite output signal of a first control circuit is maintained at a predetermined level relative to a phase characteristic of the composite output signal of a second control circuit.

14. (Previously presented) The control system of claim 12, further comprising at least one coupling element for coupling adjacent control circuits.

15. (Previously presented) The control system of claim 14, wherein the coupling element comprises a variable impedance element.

16. (Previously presented) The control system of claim 12, further comprising a plurality of coupling elements, each coupling element connected to two adjacent control circuits to thereby provide coupling between the two adjacent control circuits.

17. (Previously presented) The control system of claim 16, wherein the impedance of the coupling elements is altered to thereby modify synchronization between coupled control circuits.

18. (Previously presented) The control system of claim 12, further comprising a command input for controlling the coupling between control circuits.

19. (Previously presented) The control system of claim 12, further comprising a first cluster of control circuits and a second cluster of control circuits, the first cluster of control circuits being characterized by a higher degree of coupling between control circuits of the first cluster relative to a lower degree of coupling between control circuits of the first cluster and control circuits of the second cluster.

20. (Previously presented) A control system comprising:

a plurality of control circuits, each control circuit comprising the following elements:

an input receiving connection for receiving an input signal;

an oscillation generation circuit for generating at a first output terminal and a second output terminal an oscillation output signal having an amplitude, phase and a frequency;

a first spike generation circuit in communication with the oscillation generation circuit for generating a first spike signal when the oscillation output signal crosses a first threshold value, the first spike signal being provided at the first output terminal and the second output terminal;

a second spike generation circuit in communication with the oscillation generation circuit for generating a second spike signal when the oscillation output signal crosses a second threshold value, the second spike signal being provided at the first output terminal;

wherein the oscillation output signal, the first spike signal and the second spike signal collectively form a first composite output signal at the first output terminal, and the oscillation output signal and the first spike signal collectively form a second composite output signal at the second output terminal, such that at least one of the composite output signals is capable of controlling an actuating element, and wherein characteristic information of the actuating element is provided as part of the input signal to the control circuit to thereby adjust one of the amplitude, phase and frequency of the oscillation output signal.

21. (Previously presented) The control system of claim 20, wherein a phase characteristic of the composite output signal of a first control circuit is maintained at a predetermined level relative to a phase characteristic of the composite output signal of a second control circuit.

22. (Previously presented) The control system of claim 20, further comprising at least one coupling element for coupling adjacent control circuits.

23. (Previously presented) The control system of claim 22, wherein the coupling element comprises a variable impedance element.

24. (Previously presented) The control system of claim 20, further comprising a plurality of coupling elements, each coupling element connected to two adjacent control circuits to thereby provide coupling between the two adjacent control circuits.

25. (Previously presented) The control system of claim 24, wherein the impedance of the coupling elements is altered to thereby modify synchronization between coupled control circuits.

26. (Previously presented) The control system of claim 20, further comprising a command input for controlling the coupling between control circuits.

27. (Previously presented) The control system of claim 20, further comprising a first cluster of control circuits and a second cluster of control circuits, the first cluster of control circuits being characterized by a higher degree of coupling between control circuits of the first cluster relative to a lower degree of coupling between control circuits of the first cluster and control circuits of the second cluster.

28. (Previously presented) A robotic control system comprising:

a plurality of control circuits, each control circuit comprising the following elements:

an input receiving connection for receiving an input signal;

an oscillation generation circuit for generating at a first output terminal an oscillation output signal having an amplitude, phase and a frequency;

a first spike generation circuit in communication with the oscillation generation circuit for generating a first spike signal when the oscillation output signal crosses a first threshold value, the first spike signal being provided at the first output terminal;

a second spike generation circuit in communication with the oscillation generation circuit for generating a second spike signal when the oscillation output signal crosses a second threshold value, the second spike signal being provided at the first output terminal;

wherein the oscillation output signal, the first spike signal and the second spike signal collectively form a composite output signal which is capable of controlling an actuating element, and wherein a sensor is used to obtain characteristic information of the actuating element such that the characteristic information is provided as part of the input signal to the control circuit to thereby adjust one of the amplitude, phase and frequency of the oscillation output signal;

and further wherein the input signal is used to synchronize controlled movement of the actuation elements.

29. (Previously presented) A method of controlling a system comprising the following steps:

using a plurality of control circuits, each control circuit performing the following steps:

receiving an input signal at an input receiving connection;

generating at a first output terminal an oscillation output signal having an amplitude, phase and a frequency;

generating a first spike signal when the oscillation output signal crosses a first threshold value, the first spike signal being provided at the first output terminal;

generating a second spike signal when the oscillation output signal crosses a second threshold value, the second spike signal being provided at the first output terminal;

wherein the oscillation output signal, the first spike signal and the second spike signal collectively form a composite output signal which is capable of controlling an actuating element, and further comprising the step of obtaining characteristic information of the actuating element which is provided as part of the input signal to the control circuit to thereby adjust one of the amplitude, phase and frequency of the oscillation output signal.

30. (Previously presented) The method of claim 29, wherein a phase characteristic of the composite output signal of a first control circuit is maintained at a predetermined level relative to a phase characteristic of the composite output signal of a second control circuit.

31. (Previously presented) The method of claim 29, further comprising the step of using at least one coupling element for coupling adjacent control circuits.

32. (Previously presented) The method of claim 31, wherein the coupling element comprises a variable impedance element.

33. (Previously presented) The method of claim 29, further comprising the step of using a plurality of coupling elements, each coupling element connected to two adjacent control circuits to thereby provide coupling between the two adjacent control circuits.

34. (Previously presented) The method of claim 33, further comprising the step of altering the impedance to thereby modify synchronization between coupled control circuits.

35. (Previously presented) The method of claim 29, further comprising the step of applying a command input for controlling the coupling between control circuits.

36. (Previously presented) The method of claim 29, further comprising the step of creating a first cluster of control circuits and a second cluster of control circuits, the first cluster of control circuits being characterized by a higher degree of coupling between control circuits of the first cluster relative to a lower degree of coupling between control circuits of the first cluster and control circuits of the second cluster.

37. (Previously presented) A method of controlling a system comprising the following steps:

using a plurality of control circuits, each control circuit performing the following steps:

receiving an input signal at an input receiving connection;

generating at a first output terminal and at a second output terminal an oscillation output signal having an amplitude, phase and a frequency;

generating a first spike signal when the oscillation output signal crosses a first threshold value, the first spike signal being provided at the first output terminal and the second output terminal;

generating a second spike signal when the oscillation output signal crosses a second threshold value, the second spike signal being provided at the first output terminal;

wherein the oscillation output signal, the first spike signal and the second spike signal collectively form a composite output signal at the first output terminal, and the oscillation output signal and the first spike signal collectively form a second composite output signal at the second output terminal, such that at least one of the composite output signals is capable of controlling an actuating element, and further comprising the step of obtaining characteristic

information of the actuating element which is provided as part of the input signal to the control circuit to thereby adjust one of the amplitude, phase and frequency of the oscillation output signal.

38. (Previously presented) The method of claim 37, wherein a phase characteristic of the composite output signal of a first control circuit is maintained at a predetermined level relative to a phase characteristic of the composite output signal of a second control circuit.

39. (Previously presented) The method of claim 37, further comprising the step of using at least one coupling element for coupling adjacent control circuits.

40. (Previously presented) The method of claim 39, wherein the coupling element comprises a variable impedance element.

41. (Previously presented) The method of claim 39, further comprising the step of using a plurality of coupling elements, each coupling element connected to two adjacent control circuits to thereby provide coupling between the two adjacent control circuits.

42. (Previously presented) The method of claim 41, further comprising the step of altering the impedance to thereby modify synchronization between coupled control circuits.

43. (Previously presented) The method of claim 37, further comprising the step of applying a command input for controlling the coupling between control circuits.

44. (Previously presented) The method of claim 37, further comprising the step of creating a first cluster of control circuits and a second cluster of control circuits, the first cluster of control circuits being characterized by a higher degree of coupling between control circuits of the first cluster relative to a lower degree of coupling between control circuits of the first cluster and control circuits of the second cluster.

45. (Previously presented) The control system of claim 12, wherein the first spike generation circuit generates the first spike signal at a peak of the oscillation output signal.

46. (Previously presented) The control system of claim 12, wherein the first spike signal and the second spike signal have different amplitudes.

APPENDIX B

No evidence pursuant to §§ 1.130, 1.131, or 1.132 or entered by or relied upon by the examiner is being submitted.

APPENDIX C

No related proceedings are referenced in II. above, hence copies of decisions in related proceedings are not provided.